## INTRODUCTION

This section is intended to aid the serviceman in troubleshooting the videobeam. The "Detection of Receiver Operations" section should enable a rapid determination of what is and is not properly functioning. The "Troubleshooting Chart" should aid in directing attention to general areas which could cause a given problem; the chart will also make the servicemen aware of features which, when operating in particular modes, will give certain characteristic symptoms.

## TROUBLESHOOTING COMMENTS AND HINTS

1. It is important to realize that a non-functioning board or component is not necessarily defective; proper voltage and signal inputs as well as good wiring connections are essential. Therefore, anytime an area of the set is suspected of being faulty, always be sure that all the essentials are being provided to that area, and that all the intermediate wiring is sound. Possible intermittancies in wiring include: marginally crimped molex pins, unsoldered joints, cold solder joints, broken wires, frayed strands of wire, plugs which have loosened, etc.

   Despite our best efforts, these do occasionally show up after shipping and installation.

2. When working on the set and the horizontal output section is known to be functional, removal of the horizontal output molex connector (J/P-5) will disable high voltage generation and thus allow for safer servicing. Note, however, that fly-back pulses are required for horizontal oscillator timing, video blanking, cross-hatch generation and convergence waveforms, so these areas can only be serviced with the horizontal output section activated.

3. Whenever there is a problem with an individual tube, one can quickly determine if the tube or the associated circuitry is at fault by interchanging appropriate connectors with one of the other tubes. If the problem shifts to the second tube, the electronics are at fault, and if the first tube still malfunctions, it is a tube problem. This procedure can be employed with the tube sockets, cathode drive connectors, focus coil connectors, and deflection yoke connectors.

4. Note that the grounding of the low voltage power supplies to the chassis occur on the door rather than on the power supply itself (to prevent "ground loops"). Accordingly, when testing the power supply with J-2 removed, care must be taken to make the proper ground connections.

   In addition, (with J-2 removed) the "remote sense" feature of the 15 volt supply requires that pins 3 and 15 and pins 1 and 14 of J2 be jumpered for proper operation of the 15 volt regulator.

5. Note that height variations with the vertical hold control is normal. The proper setting is that which gives a height which just overscans the top and bottom screen edges.

## DETECTION OF RECEIVER OPERATIONS

| Operation | Detection Point | Key No. | Waveform Number, Comments |
|---|---|---|---|
| I. Special Circuitry | | | |
| 1. Scan Failure Protection | R, B, or G G1 test point | 26 | Normal state: 60 to 80V DC "Tripped" state: -160V DC |
| 2. Anode Over-Voltage Protection | 1700, Pin 11 | 21 | Normal state: 30V DC "Tripped" state: 1V DC |
| 3. +15 or +30 Regulator Current Foldback | +15 or +30 volt fuse | 18, 19 | Normal state: +15 or +30V DC "Tripped" state: 0V, fuse in; +15 or +30V DC, fuse out |
| II. Sweep Circuitry | | | |
| 1. Sync Generation | Sync test point | 23 | Composite sync, 30V p-p |
| 2. Vertical Scan | Vertical TP or | 24 | 25, Vertical Flyback |
| | 2700, Pin 5 | 13 | Vertical ramp, 3V p-p |
| 3. Horizontal Oscillator | 1700, Pin 10 | 20 | 31, oscillator output |
| 4. Horizontal Scan | Horizontal TP or | 25 | 33, Horizontal Flyback |
| | 2700 Pin 1 | 11 | Horizontal ramp, 3V p-p |
| III. Video Circuitry | | | |
| 1. IF Video Output | 400, Pin 9 | 8 | 1 |
| 2. Video chain Input | 900, TP 1 | 7 | Composite video, 3V p-p |
| 3. Combed Luminance | 900, Pin 10 | 14 | 6 |
| 4. Combed Chrominance | 900, Pin 12 | 15 | 7 |
| 5. Luminance | 1200, TP 14 | 30 | Video Information, 3V p-p with sync tips clamped to 23V |
| 6. Chrominance I signal | 1200, TP 6 | 31 | 16 |
| 7. Chrominance Q signal | 1200, TP 2 | 4 | 16 |
| 8. Local Color Oscillator | 1200, Pin 1 | 6 | 15 |
| 9. R, B, & G Signal Generation | 1200, TP 15, 16, 17 | 29 | 17, 18, 19, split field color bars 20, normal video |
| 10. Processed R, B, & G Signals | 1300, Pins 15, 16, & 17 | 2 | 21, 21A |
| 11. Cathode Drives | 1400, Heat Sinks | 1 | 22, 22A |

| | | Location | | Typical Reading | Adjustments |
|---|---|---|---|---|---|
| IV. | DC Voltages | | | | |
| 1. | 7.5 volts | 2200, Pin 9 | 10 | 7.3 to 7.7V | none |
| 2. | 15 volts | 15 volt fuse | 19 | 14.5 to 15.5V | 100, R15 |
| 3. | 23 volts | 1800 Pin 11 | 17 | 20 to 25V | none |
| 4. | 30 volts | 30 volt fuse | 18 | 29.5 to 30.5V | 100, R32 |
| 5. | 40 volts | QA 101 collector | 28 | 40 to 55V | none |
| 6. | 160 volts | Input Inductor Pin 4 | 16 | 140 to 190V | none |
| 7. | 250 volts | 1400, Pin 3 | 3 | 200 to 270V | none |
| 8. | -9.5 volts | 700, Pin 2 | 9 | -9 to -11V | none |
| 9. | -15 volts | Hor. Hold Control | 33 | -14 to -16V | none |
| 10. | -160 volts | 2700, Pin 4 Remove Board | 12 | -140 to -190V | none |
| 11. | G1—Main Supply | G1 Test Point | 27 | 100 to 120V | none |
| 12. | G1—Individual | Individual TP | 26 | 60 to 80V | KP controls |
| 13. | G2—Main | G2 Main TP | 34 | 800 to 850V | 2600, R3 |
| 14. | G2—Individual | Individual G2 Test Points | 32 | 400 to 800V | Screen controls |
| 15. | Filament Supply | Filament TP | 35 | +120V DC (from either terminal to ground) | 6.3V AC (between terminals) |
| 16. | Presence of Anode Voltage | 1700, TP 15 | 22 | 20 25V DC | |

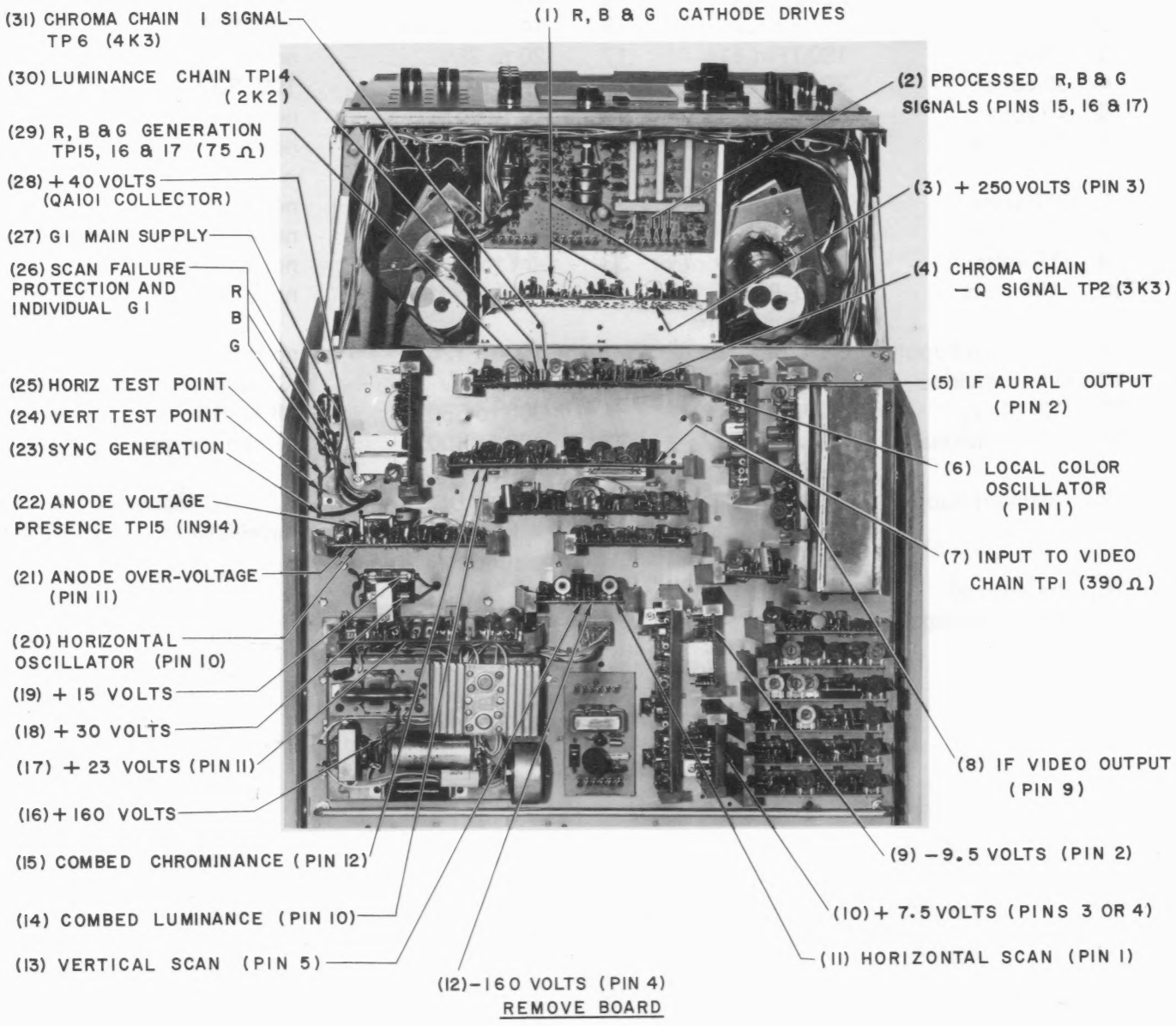


Figure 8-1. TROUBLESHOOTING KEY - OUTSIDE OF DOOR

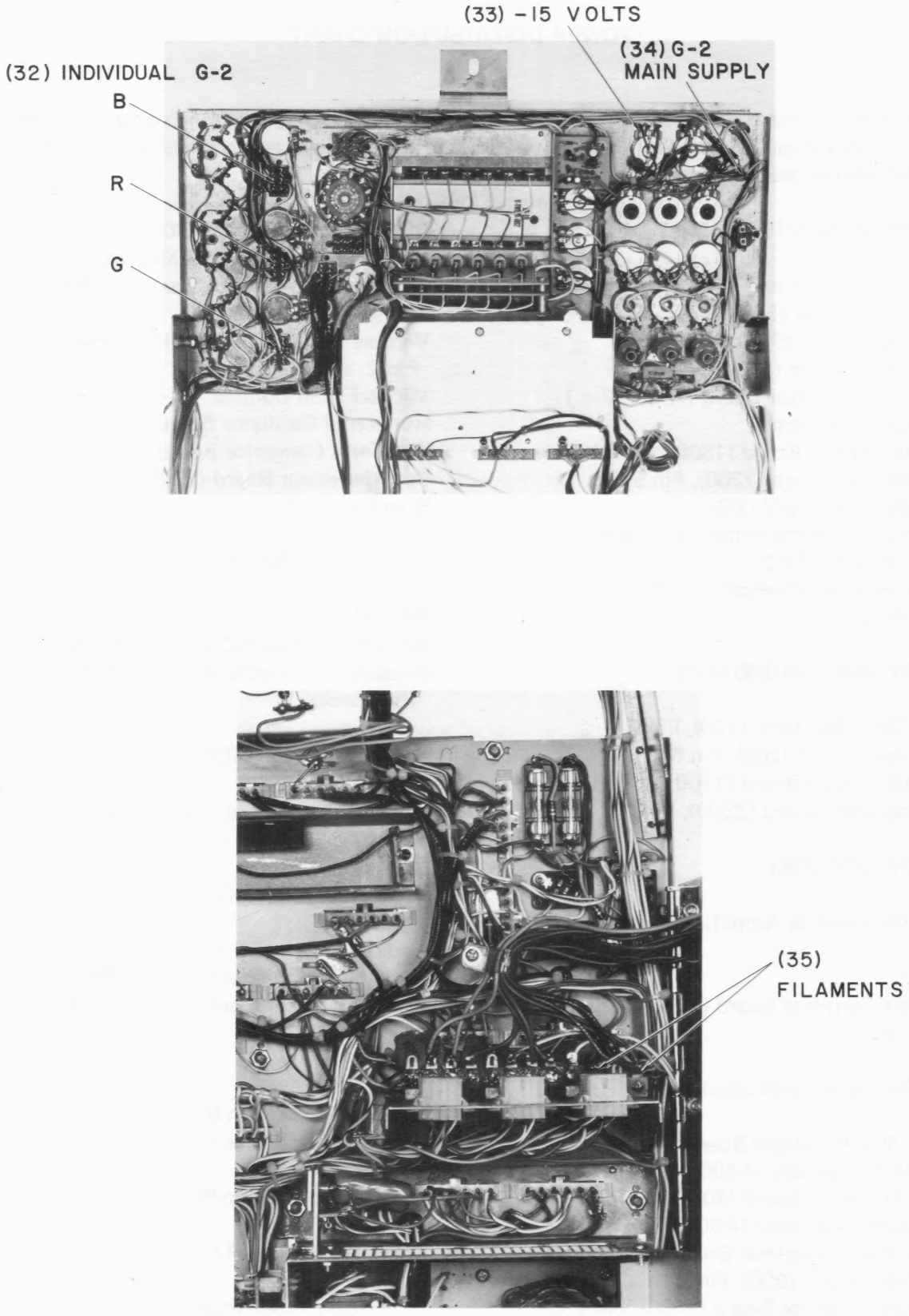


Figure 8-2. TROUBLESHOOTING KEY - INSIDE OF SUBPANEL AND DOOR

## POWER DISTRIBUTION CHART

The resistance measurements given are typical values from that rail to ground using a Simpson 260 with J/P - 2 disconnected. The first measurement is with the negative lead to the chassis, and the second is with the positive lead to the chassis.

+15V (50 ohm/15 ohm)

15V and 30V Regulator Board (100), Pin 2
Audio Demodulator (500), Pin 1
Audio Power Board (700), Pin 3
Video Output Board (1400), Pin 1
Cross-Hatch Generator Board (1500), Pin 1
Horizontal Hold Control
Horizontal Output Board (1800), Pin 14
7.5V Reference Board (2200), Pin 5, 6
Focus Regulator Board (2300), Pin 17
Dynamic Convergence Amplifier Board (3 per set) (2600), R, B, G, Pin 6
Vert. and Hor. DC Position Controls
Brightness Control

+23V (500 ohm/500 ohm)

15V and 30V Regulator (100), Pin 2
Audio Power Board (200), Pin 6
Horizontal Output Board (1800), Pin 11
Focus Regulator Board (2300), Pin 2

+40V (20K/30K)

Vertical Oscillator & Amplifier Board (1600), Pin 11
QA 101
Pincushion Corrector Board (2100), Pins 11, 12 (Interlock)

+30V (75 ohm/20 ohm)

15V and 30V Regulator Board (100), Pin 10
RF/IF/AFT Assembly (A400), J/P 22-3
AGC/IF Processor Board (400), Pins 6, 8
Tone Control Assembly (A600), Pin 1
External Video Amplifier Board (800), Pin 1
Comb Filter Board (900), Pin 2
Luminance Processor Board (1000), Pin 2, 5
Chroma System Board (1100), Pin 9, 14
NTSC Decoder Board (1200), Pin 10
RGB Processor Board (1300), Pin 11
Video Output Board (1400), Pin 2
Cross-Hatch Generator Board (1500), Pin 3 (When operating)
Vertical Oscillator & Amplifier Board (1600), Pin 2
Vertical Hold Control
Horizontal Oscillator Board (1700), Pin 2
Waveform Generator Board (2400), Pin 6
Bow Generator Board (2500), Pin 5
Scan Failure Protection Board (2700), Pin 3

+160V (25K/15 ohm)

RA 117
Horizontal Output Board (1800), Pins 5, 8
Pincushion Corrector Board (2100), Pins 5, 6 (Interlock)

+250V (15K/65K)

Video Output Board (1400), Pin 3
RA 157

-9.5V (2K5/2K)

Audio Power Board (700), Pin 2
Horizontal Oscillator Board (1700), Pin 6
7.5V Reference Board (2300), Pin 4

-15V (3K/3K)

RF/IF/AFT Assy (A400), J/P 22-5
Horizontal Hold Control

-23V (600 ohm/600 ohm)

-15V Regulator – RA 101

-160V (450K/open)

RA 156

## MEASUREMENT OF ANODE VOLTAGE

The direct measurement of anode voltage is made at the anode connector mounted on the chassis wall. This voltage should be measured only with a probe rated to 35 KV, and an accuracy of ±100 volts at 30 KV is required for anode voltage adjustments. The proper anode voltage is 29.7 to 30.3 KV.

The presence of anode voltage can be ascertained by checking the DC voltage at TP 15 on the horizontal oscillator board. This voltage is derived from the focus tap of the high voltage multiplier and is used for the anode overvoltage shut-down circuit. A reading of 20 → 25 volts indicates the presence of nominal anode voltage, and no reading indicates an absence of anode voltage.

## MEASUREMENT OF ANODE CURRENT (Total tube beam current)

The recommended procedure for anode current measurements is to insert a milliammeter in the ground return of the high voltage multiplier. This return is wired to pin 18 of the RBG processor board, and then through a 1.8K resistor (R79) to the brightness limiter circuitry. The two pins to the right of the drive controls (TP 19) are tied to either end of this resistor. Since the impedance of a milliammeter will be small compared to this resistance, such a meter can be connected across these pins (with the lower pin wired to the positive meter terminal) to measure total current drain through the multiplier, provided all three tubes are turned on. If any tube is turned off, the reading will be inaccurate due to precautionary interlocks on the tube on/off switches.

Note that the current measured here is total beam current, *plus* the current drawn by the high voltage bleeder-divider network (100 μA), *plus* the current drawn from the focus tap (100 μA), *plus* any current being drawn *if* a high voltage meter is being used. The beam current is found by simply subtracting the steady state reading (the reading with brightness and contrast controls fully down) from the reading at any given time.

## THE TROUBLESHOOTING CHART

The following troubleshooting chart is intended as an aid to efficient field servicing of the "VideoBeam". The purpose is to lead the serviceman to the areas of the set which, if malfunctioning, will give a particular symptom. Once the cause has been isolated to a particular block of the receiver (such as power supply, video chain, etc.), referring to that particular section in the circuitry section should provide ample detailed information for repairs.

Note that, in many cases, the cabinet top does not require removal, and in most cases the chassis door does not need to be opened. It is best to first analyze the situation and to then decide what must be disassembled in order to make repairs.

| | | Possible Problems | |
|---|---|---|---|
| | **Complaint** | **Cabinet Removal Unnecessary** | **Cabinet Removal Necessary** |
| I. | Poor Picture<br>snowy, ghosty, interference, poor color, fuzzy | 1. Poor antenna or reception<br>2. Improper screen-projector alignment<br>3. Improper fine tuning<br>4. Improper settings of user controls | 1. Defective RF/IF/AFT assembly<br>2. Defective AGC/IF board or adjustments |
| II. | Dim Picture<br>(full brightness and contrast) | 1. Improper viewing angle<br>2. Excessive ambient light<br>3. Improper fine tuning<br>4. Cutoffs (screens) improperly set<br>5. Drives improperly set | 1. Improper AGC setting or defective AGC/IF proc. board<br>2. Defective RF/IF/AFT assembly<br>3. Improper brightness limiter setting or defective RBG proc. board<br>4. Defective clamp diode (DA 3) in trippler return<br>5. Defective "on/off" switch (filaments on standby) |
| III. | Color Problems<br>(none, color bands, lack of saturation, improper tint control, range, etc.) | 1. Improper fine tuning<br>2. Weak RF signal<br>3. Improper color killer setting<br>4. Poor grayscale (screens or drives misadjusted) | 1. Improper chroma system settings or defective CS board<br>2. Improper NTSC decoder settings or defective NTSC decoder board |
| IV. | No Picture, No Sound, No Tuner Lights | 1. Circuit breaker has tripped<br>2. Faulty AC outlet | 1. Faulty circuit breaker<br>2. Power supply molex unplugged |
| V. | No Picture, No Sound<br>(tuner lights, o.k.) | 1. Thermostat on control panel tripped due to external heating source. | 1. Faulty +15 volt line<br>2. Faulty +30 volt line<br>3. Faulty RF/IF/AFT assembly<br>4. Faulty power transformer<br>5. Faulty fan (causing overheating)<br>6. Clogged fan filter (causing overheating) |
| VI. | No Picture, No Tuner Lights<br>(sound o.k.) | | 1. Fuse for filament transformer blown (under power supply chassis)<br>2. Faulty filament transformer |
| VII. | No Sound<br>(picture o.k.) | 1. Improper fine tuning | 1. Faulty audio chain |

| Complaint | Possible Problems: Cabinet Removal Unnecessary | Possible Problems: Cabinet Removal Necessary |
|---|---|---|
| VIII. No Picture (sound & tuner lights o.k.) | 1. Improper setting of user controls<br>2. "Service-Normal" switch in "service" position<br>3. Anode overvoltage protection has tripped due to transient causing a momentary rise in HV. (Turn set of for roughly one minute to allow for resetting.)<br>4. Scan failure protection has tripped due to insufficient vertical scan (vert. hold and/or master height mis-set). | 1. Anode overvoltage protection has tripped.<br>a. high voltage is not regulated or is poorly regulated – causes may be:<br>1) Faulty +15 volt or +23 volt supply to HV cage<br>2) Defective high voltage regulator (1800 board)<br>3) Hor. osc. is out of sync, running fast (adjust hor. hold).<br>4) Faulty tripler-divider assembly.<br>b. Improper anode overvoltage protection setting or defective horizontal oscillator board.<br><br>2. Scan failure protection has tripped<br>a. No vertical scan or insufficient vertical scan.<br>1) +30 or +40 volts not present<br>2) vert. output fuses blown<br>3) faulty vert. output device<br>4) Defective vertical oscillator board (1600 board)<br>b. No horizontal scan (assuming anode overvoltage has not tripped)<br>1) No trigger pulses (defective horizontal oscillator board (1700)<br>2) +160 volts not present on HV cage<br>3) faulty trace or retrace diode or SCR<br>4) faulty commutating coil<br>5) faulty commutating capacitor<br>6) yoke circuit open or shorted to ground<br>7) defective horizontal output board (1800)<br>c. Improper scan failure adjustment settings or defective scan failure circuit (2700 board)<br>3. 2000 board (no G2 voltage)<br>4. Faulty G1 supply (G1 zener diode) (DA 105)<br>5. No high voltage (assuming anode overvoltage and scan failure protection circuits have not tripped)<br>a. Faulty flyback transformer (1900 board)<br>b. HV connector unplugged<br>6. No cathode drives (faulty video chain) |

| | Complaint | Possible Problems: Cabinet Removal Unnecessary | Possible Problems: Cabinet Removal Necessary |
|---|---|---|---|
| IX. | Circuit Breaker Trips a Few Seconds After Turn On | | 1. Faulty power supply – some rectifier diode is shorted (determine by pulling power supply output molex (J-2) and observing the breaker still trips)<br>2. Excessive current being drawn in +160 volt line by HV cage (determine by pulling HV cage molex and observing if circuit breaker trips)<br>a. Faulty trace or retrace SCR or diode<br>b. Faulty commutating coil<br>c. Yokes shorted to ground<br>d. High voltage shorted to ground (defective tube, faulty HV divider block, faulty anode wiring, etc.)<br>e. Defective high voltage regulator (1800) board)<br>3. Too much current is being drawn in some other voltage rail<br>4. Faulty power transformer<br>5. Faulty filament transformer<br>6. Faulty circuit breaker |
| X. | All Tubes Fail to "Go Through Focus" | 1. Excessively low line volt age (105 volts) or high-line voltage (130 volts)<br>2. ΔHV control requires adjustment<br>3. TV is being run in excessively hot or excessively cold environment | 1. Improper high voltage<br>a. Improper HV regulator setting or defective regulator (1800 board)<br>b. +160 volt supply is excessively high or low<br>2. Defective focus regulator (2300 board) |
| XI. | Dynamic Convergence Is Poor | 1. Improper screen-projector alignment | 1. Improper convergence set up<br>2. Improper actions of convergence controls<br>3. Defective 7.5 volt reference (2200 board) |
| XII. | Sharp Double Image (not an antenna ghost) | | 1. Defective retrace SCR<br>2. Defective horizontal oscillator (1700 board)<br>3. Defective video delay line |
| XIII. | One Tube Fails to "Work" | 1. Corresponding switch is off<br>2. Corresponding screen or drive control has been turned fully down | 1. Anode connector is not plugged in<br>2. Cathode in-line molex connector is not connected<br>3. Improper G1 or G2 voltages<br>4. Defective video channel<br>5. No filament voltage present at the tube.<br>6. Defective tube |

| Complaint | Possible Problems: Cabinet Removal Unnecessary | Possible Problems: Cabinet Removal Necessary |
|---|---|---|
| XIV. One Tube is Very Bright (swamps out other colors) | 1. Drive controls or screen controls mis-set | 1. Defective video channel<br>2. Carbonized material in cathode arc gap. |
| XV. One Tube Fails to Focus (no response to focus control) | | 1. Defective channel on focus regulator (2300 board)<br>2. Focus molex is unplugged<br>3. Focus magnet is loose<br>4. Focus coil is open or shorted (defective tube) |
| XVI. One Tube is Unstable (varying size and/or brightness) | | 1. Unstable G1 or G2 voltages (faulty G1 or G2 pots or arc gaps)<br>2. Defective video channel<br>3. Anode connector not making good contact<br>4. Defective Tube |
| XVII. One Tube Does Not Converge to Other Two | | 1. Corresponding DCA board (2600) is defective<br>2. Yoke has slipped or rotated on tube neck<br>3. Defective tube |
| XVIII. One Tube Turns on Very Slowly | | 1. Defective tube – losing its emission |